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Experimental Investigation of Split air Conditioning System by liquid Based Cooling System

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ABSTRACT

The majority of the research work focused large chillers. But in this paper discusses the single split air conditioning system using instead of air cooling using liquid based cooling. The coolant used in the heat exchanger pure ethylene glycol. Compare the experimental results value of existing system with new modified system. The compressor running time for the pure ethylene glycol based cooling system is less than the existing system. The compressor's running time is reduced from 44 minutes 30 seconds to 33 minutes and 4 seconds. The required indoor temperature of 18°C is reached in 11 minutes 26 seconds earlier. It is evident that the time taken for cooling by the modified system is 25.69 % less than that of the existing split air condition system. Time taken for cooling reduces automatically improve the efficiency of the air conditioning system.

Keywords: liquid cooling, compressor, ethylene glycol, helical coil, split conditioning system.

1. INTRODUCTION

Residential buildings account for almost major of total energy consumption. Nearly all of the greenhouse gas emissions from the residential sector can be attributed to energy use in buildings. Adapting the new efficient technology can reduce GHG emission. Energy consumptions for space heating, cooling, and air conditioning account for almost 40 % of total residential building energy end use. Air conditioners are classified into two types. They are Window air conditioners, and Split air conditioners. Now a day split air conditioners play a more major role than the window air conditioners, among the reasons for choosing a split air conditioner is the fact that the installation is simpler compared to the installation of a window air conditioner. Also, the cooling effect in a window air conditioner is more effective than that in a split air conditioner; whereas the power consumed is considerably higher than that of the split air conditioner. Extensive research work was under-taken by YU et al (2006) improved the condenser design and condenser fan operation. Qi et al (2009) had done the multivariable control of indoor air temperature and humidity in a direct expansion air conditioning system. Zhou et al. (2008) had done the simulation and experimental validation of VRV system using energy plus. Lung-yue jeng et al (2013) had done the hybrid cooling system for electronic chips. The study performed by Schiaven and Million (2008) infers that the air movement in indoor environments caused by increasing the fan speeds to conserve the energy spent on cooling without sacrificing the occupant's thermal comfort. Parameshwaran et al (2010) achieved air conditioning system energy conservation, by optimizing the supply air temperature using fuzzy and genetic algorithms. Chiou et al (2009) designed an energy saving system for multiunit room air conditioners using fuzzy control. Koloskotsa et al (2009) performed energy and indoor environmental quality management using a model-based predictive controller. Sathiamurthi et al (2011) designed a waste heat recovery system for air conditioning unit. In this research work liquid based cooling system implemented compared with existing system compressor running time.

2. EXPERIMENTAL WORK

The Present research work is based on the energy conservation in the single split air-condition system. For the testing purpose, an existing 1.5 ton capacity split air conditioning system was used. Initially the existing system was fitted in the test room. The existing split air conditioning system working under a vapour compression cycle. The working component of both the window and split air conditioner is same such as the compressor, evaporator coil, and condenser coil and expansion valve. But where in window air conditioner the whole set up is provided in a single box and in the split air conditioner the compressor, condenser coil (blower fan) and expansion valve is made into a unit termed as outdoor unit. Then the evaporator coil with the blower fan is attached inside the room or space to be cooled is termed as indoor unit. All controls to the air conditioner are made in the indoor unit. Then the special heat exchanger attached to the split air condition system. The modified system is shown in Figure 1.

4. RESULTS AND DISCUSSIONS

On a particular day, the existing split air conditioning system without the inter cooler is tested. Initially, the room and atmospheric temperatures are measured. The room temperature is 28°C.The required cooling temperature fixed in of 26°C is

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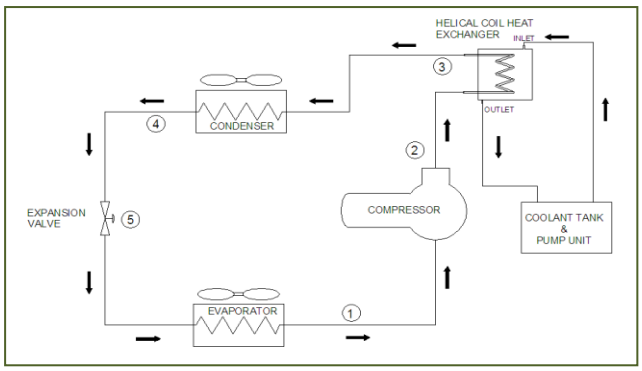

Figure 1
Modified system

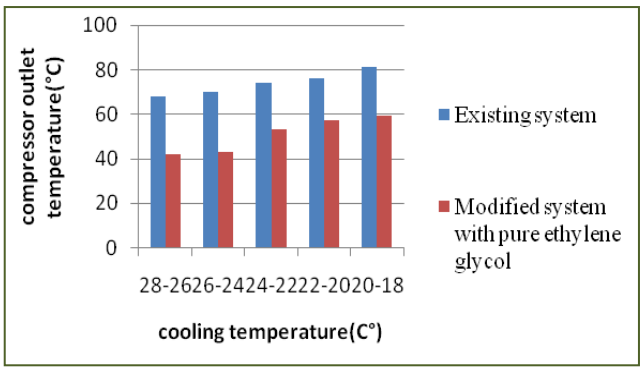

Figure 2
Comparison of compressor outlet temperature

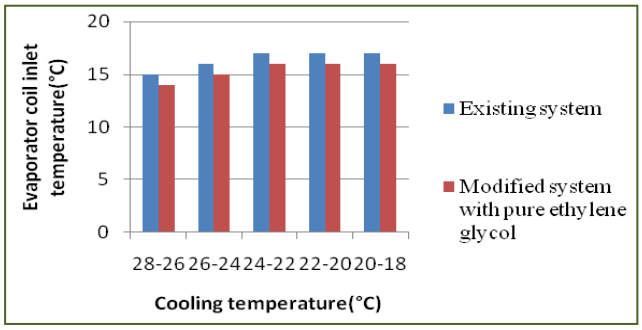

Figure 3
Comparison Evaporator coil inlet temperature

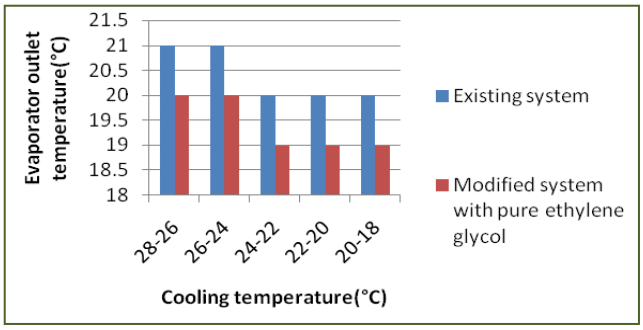

Figure 4
Comparison of Evaporator coil outlet temperature

fixed in the existing air conditioning system. The time required to reach the cooling temperature is recorded by a stop watch. The Condenser entry and exit temperatures are measured. The Compressor inlet and outlet temperature are measured. The same parameters are measured for the cooling temperatures of 24°C, 22°C, 20°C, and 18°C. Similarly,the modified system is also tested. The comparison of the compressor outlet temperature for the existing and modified intercooler fitted air conditioning is shown in Figure 2. It shows that the existing system's condenser inlet temperature is always greater than the modified system. The inter-cooler fitted modified system reduces the condenser inlet temperature, and the condenser work. It's automatically reduces the heat wasted to the atmosphere the comparisons of the evaporator coil inlet temperature existing and intercooler fitted modified system shown in Figure 3. It shows the evaporator inlet temperature in the modified system was less than that in the existing system. Evaporator inlet temperature decreases due to the effect of the inter cooler fitted in the modified system and also the liquid cooling system. The evaporator inlet temperature reduces create the sub cooling effect on the air-conditioning system. it is directly increases the cooling effect of the air conditioning system. The comparisons of the evaporator coil outlet temperature existing and intercooler fitted modified system shown in Figure 4. The evaporator coil outlet temperature is always less than the Intercooler fitted modified system. Evaporator outlet temperature decreases due to the effect of the inter cooler fitted in the modified system. The comparisons of the cooling time between existing and inter cooler fitted modified system shown in the figure 5. Comparisons of the cooling time for intercooler fitted system modified system are always having the less time to reach the required room cooling temperature. It shows, the reduces the compressor work in the modified system indirectly increases the air conditioning efficiency.

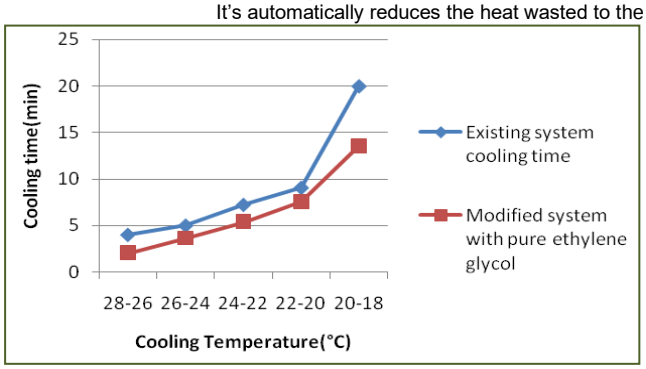

Figure 5
Comparison of compressor outlet temperature

5. CONCLUSION

An intercooler was attached to the modified split air conditioning system. Comparing the existing and modified Split air conditioning systems, the time taken to reach the required cooling temperature in the modified air conditioning system was lesser than that in the existing air conditioning system. It directly reduces the compressor's work. The reduction of the compressor's work improves the energy saving. In future work, the test maybe conducted split air conditioning systems with an intercooler, changing ratio of water and glycol ratio with addition of nano particles in different volume concentration.

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